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ARTHRODESIS AFTER INFECTED KNEE ARTHROPLASTY USING AN
INTRAMEDULLARY NAIL. Reports of Four Cases

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Arthrodesis After Infected Knee Arthroplasty Using an Intramedullary Nail*

Reports of Four Cases

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Summary. In the treatment of knee arthroplasty failures intramedullary nail arthrodesis may be used to achieve stability if compression arthrodesis is not indicated or has failed.

Four case reports illustrate this technique in the treatment of infected knee arthroplasties. A two-stage procedure is recommended, first eradication of all foreign and infected material and temporary use of gentamicin beads and four weeks later intramedullary nail fixation and massive bone transplantation. The nailing technique is discussed.

Zusammenfassung. Bei der Behandlung einer gescheiterten Kniegelenks-Alloarthroplastik kann eine intramedulläre Nagelarthrodesis verwendet werden, um eine Stabilisierung zu erreichen, und zwar dann, wenn eine Kompressionsarthrodesis nicht indiziert ist oder bereits vorher versagt hat.

Die Berichte von vier Fällen illustrieren diese Technik bei der Behandlung von infizierten Kniegelenksplastiken.

Ein Zwei-Stufen-Verfahren wird empfohlen: Zuerst wird eine Ausräumung aller Fremdkörper und des infizierten Gewebematerials unter vorübergehender Verwendung von Gentamycin-Kugeln durchgeführt. Vier Wochen danach erfolgt eine intramedulläre Fixation und eine massive Knochentransplantation. Die Nagelungstechnik wird diskutiert.

Introduction

Arthrodesis as a primary treatment for arthropathy is today easily performed resulting in fusion in nearly all

cases (Charnley and Baker 1952). The use of external fixation as a single frame (Charnley 1948) or a double frame (Connes 1973) has long been used for knee-fusion. Arthrodesis of the knee in the treatment of infected knee arthroplasty has a high failure rate. Twenty-five to 45 per cent non-unions have been reported when treating infected hinged endoprostheses (Hageman et al. 1978; Brodersen et al. 1979).

We have used compression arthrodesis with external double frame fixation in the treatment of infected knee endoprostheses during the last 5 years. As one of our patients failed to fuse despite adequate external fixation, internal fixation became necessary (Case 1). Intramedullary reaming and rodding have been suggested as a method to achieve arthrodesis in difficult cases (Macys and Froimson 1973). Diaphysary pseudarthrosis with a low grade infection has been intramedullary reamed and rodded under systemic antibiotic treatment without septic complications (Christensen 1973; Lidgren and Törholm 1980; Lidgren and Önnarfält 1981). The aim of the following study is to present four arthrodeses using a modified long Küntscher nail in the treatment of septic knee arthroplasty.

Case Reports

Case 1. A 46-year-old woman with seronegative rheumatoid arthritis and severe cartilage destruction of the right knee was treated with a Guépar hinged endoprosthesis. A medial transposition of the patellar ligament with staple fixation was done because of perioperative patellar luxation. Five years postoperatively a three centimetre large bursa with amorphous content was found over the staple. The bursa and staple were extracted and perioperative bacterial cultures were negative. The incision did not heal and septic arthritis and a fistula developed. One month later when the endoprosthesis was extracted, alfa-streptococci were found in bacterial cultures from 5/5

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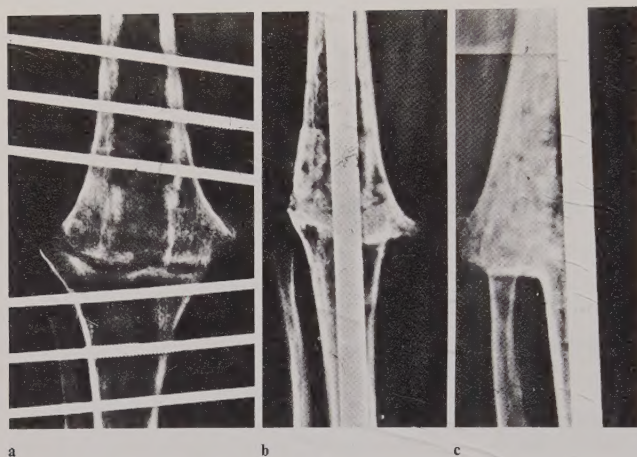


Fig. 1a-c. Case 1. A 46-year-old woman with rheumatoid arthritis and an infected Guépar arthroplasty of the right knee. **a** Pseudarthrosis after six months with external double frame fixation. **b** AP view of the knee. Fused with a long Küntscher nail. **c** Lateral view. Nail and tibia ventrally displaced

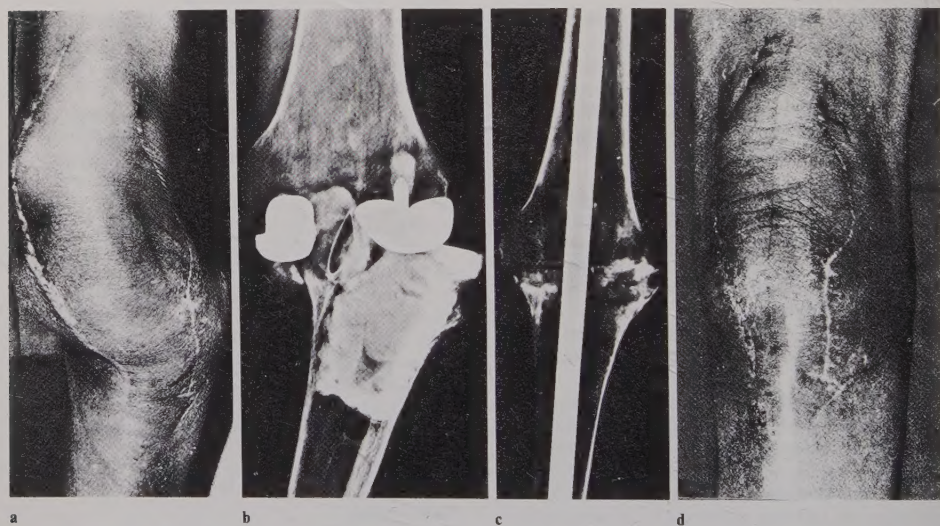


Fig. 2a-d. Case 2. A 64-year-old man with rheumatoid arthritis. Medial and lateral Marmor arthroplasty with deep infection and gross instability. **a** The unstable infected knee before fusion. **b** AP view. A large bone cyst with bone cement. Tibial component loosening. **c** AP view of the knee after fusion and massive bone transplantation. **d** The fused and stable knee

tissue biopsies. Knee-fusion was attempted with an Audrey-Vidal double frame external anchorage and gentamicin beads in the joint cavity. Remaining fistulas were revised three months postoperatively. The Audrey-Vidal anchorage was replaced with a bandage after six months. A painful pseud-

arthrosis developed (Fig. 1a), and 15 months after the arthrodesis a new attempt was made. A long Küntscher nail from trochanter major to midtibia was used together with an orthosis. After a year the knee was osseously fused, painfree and had no signs of deep infection (Fig. 1b, c).

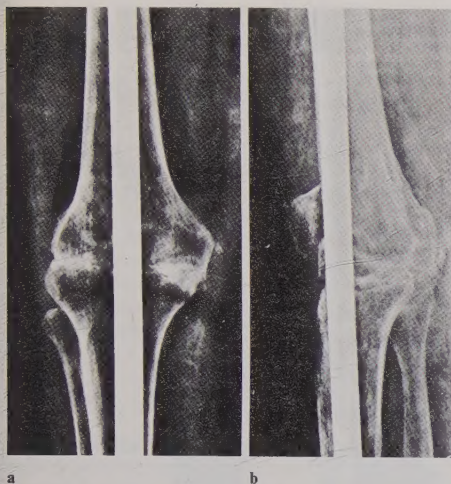


Fig. 3a, b. Case 3. A 76-year-old woman with panarthrosis fused because of infected knee arthroplasty. **a** AP view. Good bony contact between condyles. **b** Side view. Ventralization of the nail and tibia is minimized through a ventral trochanteric introduction of the nail

Case 2. A 64-year-old man with seronegative rheumatoid arthritis was treated in his left knee with a lateral unicompartmental Marmor prosthesis. A large cyst in the lateral tibia was filled with bone cement. A year and a half later the knee was reoperated because of medial articular derangement with varus instability. A medial Marmor endoprosthesis was used. Postoperatively a prolonged discharge and a medial tibial component loosening were found (Fig. 2b). Six months later the endoprosthesis was removed because of gross instability (Fig. 2a). Knee fusion was performed with a long Küntscher nail and massive bone transplantation (Fig. 2c). 5/5 tissue biopsies showed growth of *Streptococcus faecalis* haemolyticus. One year postoperatively the knee was stable, painfree and had no signs of deep infection (Fig. 2d).

Case 3. A 76-year-old woman with panarthrosis of the right knee was treated with a Total Condylar endoprosthesis. Five months postoperatively the knee was affected by septic arthritis with a ventral abscess, septicemia and *Staphylococcus aureus* in the joint. The endoprosthesis was extracted 2 weeks later, the joint-cavity filled with gentamicin beads and a dorsal plaster was applied. One month later knee-fusion was performed with a long Küntscher nail from trochanter major to midtibia (Fig. 3a, b). One year postoperatively the knee was stable, painfree and had no signs of infection.

Case 4. A 46-year-old male with post-traumatic osteoarthritis was treated in his left knee with a Guépar endoprosthesis. Six months later septic arthritis with fistulas developed. Two years postoperatively the knee was explored and a large amount of granulation tissue was found in the joint and around the intramedullary stems. This was removed and gentamicin-containing bone cement was added in the bony defects. The knee was

functioning well without fistulas for 6 months after this. The procedure was repeated three and 5½ years postoperatively because of recurrent fistulas (Fig. 4a). Repeated cultures showed growth of *Staphylococcus aureus*. The endoprosthesis was finally removed after 6 years because of progressive osteomyelitic bone destruction. The knee cavity was filled with gentamicin beads for 1 month and then knee-fusion was performed with a long proximally slightly curved Küntscher nail (Fig. 4b, c). During the rodding an oblique fissure of the subtrochanteric region developed. This was fixed with three Partridge nylon-straps (Partridge 1976) at the end of the operation. Six months later the fracture and the arthrodesis had healed without any signs of infection.

Discussion

To achieve bone fusion after extraction of an infected knee-endoprosthesis, especially of the hinged type, is not easy. We have now applied the intramedullary reaming and rodding (Küntscher 1967) as illustrated by the four arthrodeses reported. Five more non-infected knees, not presented, have been operated during the same period and all developed fusion. Three more infected knee arthroplasties operated later are progressing towards union without complications.

Local eradication of the infectious lesion and reaming of the intramedullary cavity in cases of chronic osteomyelitis have not been shown to produce postoperative sepsis (Lidgren and Törholm 1980). Introducing an intramedullary rod may, however, increase the risk. This could probably be eliminated by a two-stage procedure where the first is to remove the infected knee-endoprosthesis and all of the bone cement as well as all infected debris. The space between femur and tibia and the medullary cavity is then filled with gentamicin-containing beads. The knee is stabilized with a dorsal plaster of Paris and the patient can after a few days in bed be mobilized to crutches. Systemic antibiotics are started preoperatively after tissue biopsies for cultures have been taken (Kamme and Lindberg 1981).

The second stage is performed after about 4 weeks when the wound is well healed. Antibiotics are continued according to the cultures. At the operation the antibiotic-containing beads are extracted. A tourniquet is used and the reaming is first performed from the trochanter in the femur and then from the knee distally in the tibia. Reaming to 14 mm is usually possible and the length of the nail is then evaluated with the help of a fluoroscope. The tip of the nail should pass below the narrowest part of the tibia. The most often used nail length is within the range of 54–64 cm (Orthopedia Kiel).

The nail should be inserted ventrally in the trochanter major to achieve a more dorsal position in the



Fig. 4a-e. Case 4. A 46-year-old man with post-traumatic osteoarthritis and an infected Guépár endoprosthesis. **a** AP view. Large bony defects after prolonged infection and revisions. **b** AP view. Prosthesis extracted and joint cavity filled with gentamicin containing beads. **c** AP view. Nail and brace fixation. Bone ends trimmed for maximal contact. **d** Side view. Proximally curved nail because of pronounced curvature of the femur. **e** The nail used

knee (Case 1 and 3). A proximally curved nail was necessary in case 4 because of the short and strongly curved femura.

A large amount of spongy bone should be transplanted from the crista iliaca (Case 2). This can be taken out through the same incision as used for rodding. The patella is denuded and placed over the knee joint. The protruding edges of the remaining condyles are chiseled off and may be used for transplantation. Decortication is performed on the proximal tibia and distal femur. The posterior capsular attachment may have to be dissected to get a good position of the bone edges (Case 4). A small suction drain is used. The patient is kept in bed for a few days and then mobilized to crutches and a dorsal plaster of Paris is used for ad-

ditional rotatory stability (Case 1). After 6 weeks full weight-bearing is started. If rotatory stability is not achieved within 4 months a new bone transplantation may be indicated. This was however not necessary in any of our cases. The antibiotic treatment should continue until there are no further signs of deep infection and radiological osseous fusion is confirmed, usually more than half a year.

The patient should be aware of the risk of reoccurring infection with a flare up of local redness and pain. In such a case the patient should be immediately readmitted for treatment which may eventually include removal of the nail.

Intramedullary nail arthrodesis may be a useful way of achieving stability if standard arthrodesis tech-

niques have failed in the treatment of infected knee arthroplasties (Case 1). The alternative is the constant use of a brace. An added indication for long Küntscher nail fixation is the combination of knee arthroplasty revision and femur and/or tibia shaft fractures.

Contraindications for this method are arthroplasty of the hip and healed shaft fractures with gross dislocation. A relative contraindication is a marked curvature of the femur. A straight Küntscher nail tends to pass the joint in the ventral region if the curvature is normal (Case 1 and 2). Distending the skin of the knee like a tent is avoided through a ventral introduction of a proximally curved nail (Case 4). The size and length of the nail should be carefully calculated before operation on full leg radiographs.

Conclusion

Arthrodesis after infected knee-prosthesis is usually performed using an external double frame fixation. Internal fixation may sometimes be indicated. We report four patients operated with reaming and rodding with a modified long Küntscher nail. The procedure should be performed as a two-stage operation with extraction of the prosthesis and all infected material and local implantation of antibiotic beads in the first stage. During 4 weeks systemic antibiotic treatment is carried on and then the knee could be stabilized with a long Küntscher nail and the joint cavity filled with massive spongy bone transplantation. The joint is further protected with a dorsal brace or

orthosis until clinical stability but weight-bearing is started after 6 weeks.

References

- Brodersen MP, Fitzgerald RH, Peterson LFA, Coventry MB, Bryan RS (1979) Arthrodesis of the knee following failed total knee arthroplasty. *J Bone Jt Surg* 61-A : 181-185
- Charnley J (1948) Positive pressure in arthrodesis of the knee. *J Bone Jt Surg* 30 B : 478-486
- Charnley J, Baker SL (1952) Compression arthrodesis of the knee. *J Bone Jt Surg* 34-B : 187-199
- Christensen NO (1973) Küntscher intramedullary reaming and nail fixation for non-union of fracture of the femur and tibia. *J Bone Jt Surg* 55-B : 312-368
- Hageman WF, Woods GW, Tullos HS (1978) Arthrodesis in failed total knee replacement. *J Bone Jt Surg* 60-A : 790-794
- Kamme C, Lindberg L (1981) Aerobic and anaerobic bacteria in deep infections after total hip arthroplasty. *Clin Orthop* 154 : 201-208
- Lidgren L, Törholm C (1980) Intramedullary reaming in chronic diaphyseal osteomyelitis. *Clin Orthop* 151 : 215-221
- Lidgren L, Önnerrfalt R (1981) Infected non-union of the tibial shaft treated by Küntscher intramedullary reaming and nail fixation. *Acta Orthop Scand* (in preparation)
- Macys JR, Froimson AI (1973) The use of a long intramedullary nail in the treatment of a failed knee fusion. *Clin Orthop* 97 : 261-262
- Partridge A (1976) Nylon straps for internal fixation of bone. *Lancet* 4 : 1252

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